# ADOT
# Air Quality Management Guidebook

## Nogales $PM_{2.5}$ / $PM_{10}$ Nonattainment Area Case Study

### Goal: Demonstrate Recommended Approaches

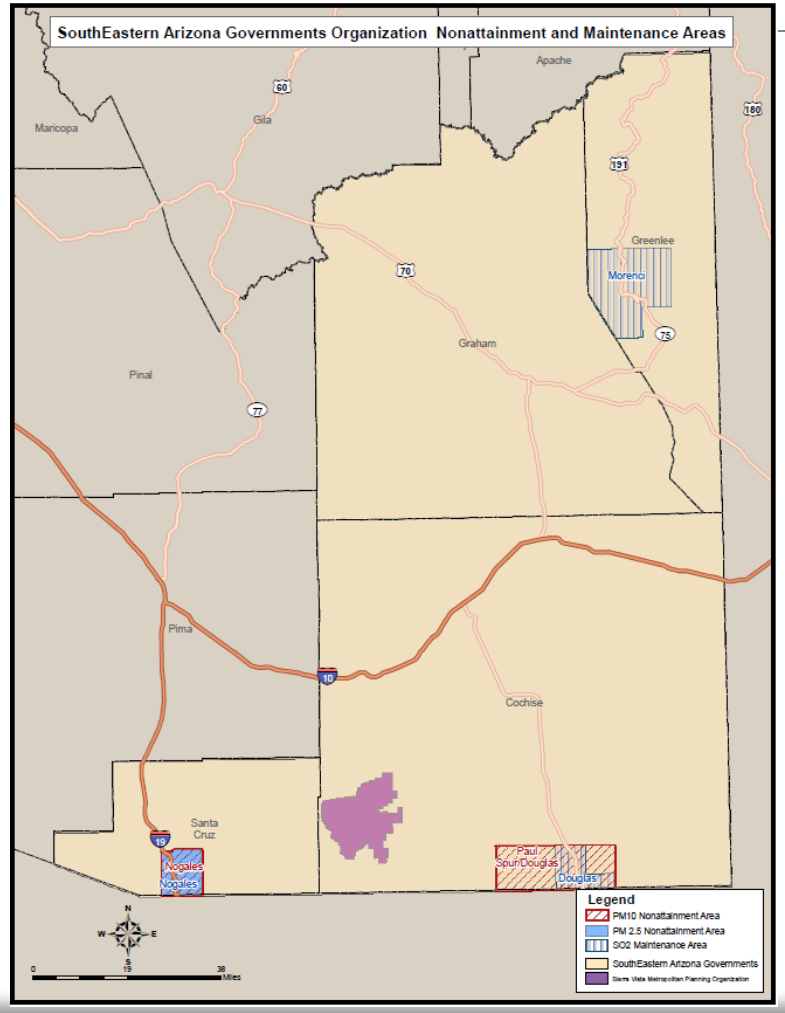
# Outline

## *Nogales $PM_{2.5}$/ $PM_{10}$ Nonattainment Area Case Study*

- Introduction & Air Quality Background
- Interagency Consultation Procedures
- Transportation Control Measure Analysis
- Conformity Analysis Procedures
- Process Demonstration

# Air Quality Overview

## *Nogales $PM_{2.5}$/ $PM_{10}$ Nonattainment Area Case Study*




| County | Current SIP Status[1] | Notes *(as of February 1, 2013)* |
|---|---|---|
| *Nogales, AZ $PM_{2.5}$ Nonattainment Area* | | |
| Santa Cruz (P) | Attainment Finding Effective 2/6/2013 78 FR 887 | Area remains nonattainment until a Maintenance Plan is submitted and approved. Regional conformity still applies. |
| *Nogales, AZ $PM_{10}$ Moderate Nonattainment Area* | | |
| Santa Cruz (P) | 2012 SIP Approval Effective 10/25/2012 77 FR 58962 | EPA approved the plan element demonstrating that the Nogales nonattainment area is attaining the NAAQS for PM10, but for international emissions sources in Nogales, Mexico. |

TABLE 1—2011 NOGALES NA $PM_{10}$ MOTOR VEHICLE EMISSIONS BUDGET

[tons]

| Source category | $PM_{10}$ |
|---|---|
| Unpaved Road Dust ..... | 864.9 |
| Road Construction Dust ..... | 267.0 |
| Paved Road Dust ..... | 121.4 |
| On-road Gasoline and Diesel Vehicle Emissions, including Brake, Tire Wear, and Vehicle Exhaust ..... | 21.0 |
| Total ..... | 1,274.3 |

# Interagency Consultation Procedures

## *Nogales $PM_{2.5}$/ $PM_{10}$ Nonattainment Area Case Study*

- Background on ICG Requirements
- Example Roles / Responsibilities
- Example Items Determined through ICG
  - Analysis Year(s)
  - Latest Planning Assumptions
  - Models to be Used

# Conformity Analysis Approach

## *Nogales $PM_{2.5}$/ $PM_{10}$ Nonattainment Area Case Study*

- Overview
- Analysis Tools and Software
- Process Development Details
- Process Structure and Operation
  (Review of Setups & Runs on Baker Network Computer)
- Sample 2008 Emission Results
- Possible Process Modifications

# Conformity Analysis Approach
## *Overview*

- Sample emission calculation framework using:
  - ✓ EPA's MOVES2010 Emission Model
  - ✓ Arizona Statewide Travel Model Data
  - ✓ Available ADOT sample files
  - ✓ AP-42
- Area:
  - ✓ Santa Cruz County
  - ✓ Nogales PM10 Nonattainment Area
- 2008 Analysis Year (July Weekday)

# Focus Goals of Case Study Analysis

## Integrate Pre/Post Processing Methodologies

- Use existing software
- Recalculate model speeds – expand to 24 hours
- Automatically prepare MOVES traffic input files
- Revise vehicle mapping schemes

## Batch Processing

- Integrate batching methods using available software
- Create menu-driven process
- Run MOVES in batch mode based on user inputs to menu screen

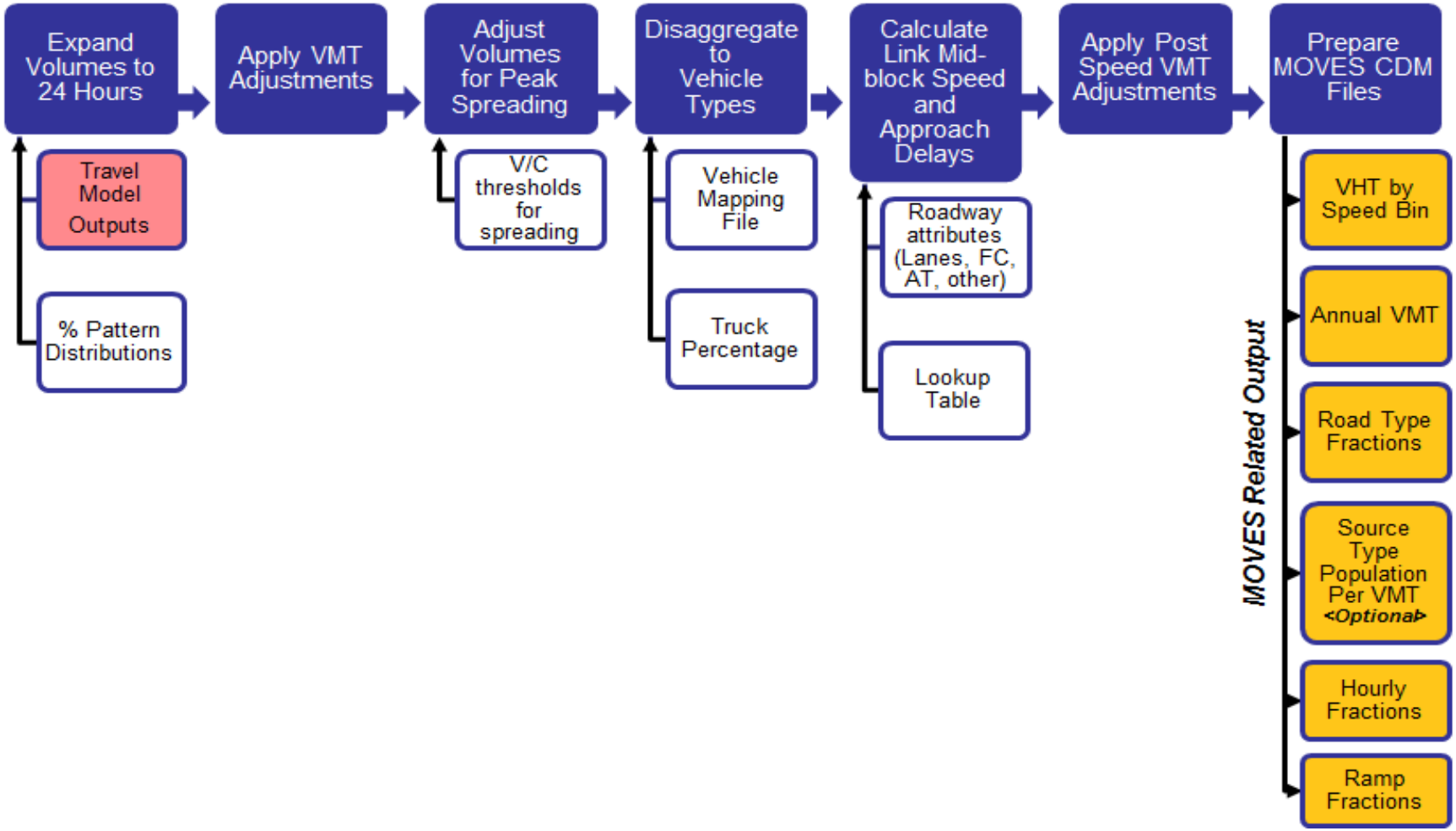
## File Management

- Allow for automated file naming through process
- Create organized directory structure to store/manage data
- Focus on structure for maintaining data for multiple counties/areas

# Selection of Tools and Software

- Based on those discussed in WP#3
- PPSUITE / CENTRAL
  - ✓ Off-the shelf software requiring setup
  - ✓ Can represent methods/procedures to incorporate in other customized software
  - ✓ Designed to link and operate with alternative traffic data sources (model and non-model data)
  - ✓ Used for past regional SIP/Conformity activities in other states (PA, NJ, MD, LA, WV, NYC, VA)

# Role of PPSUITE



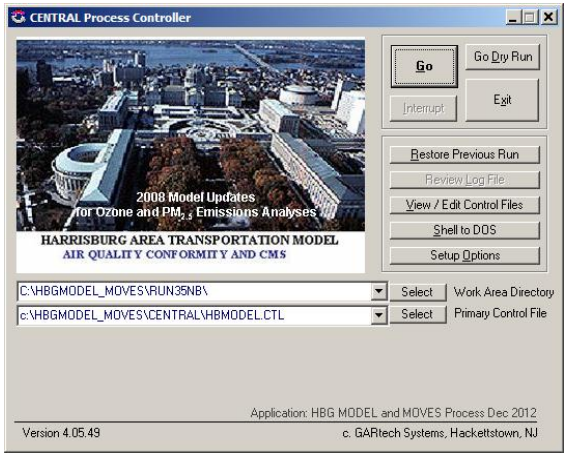
# How to Setup PPSUITE

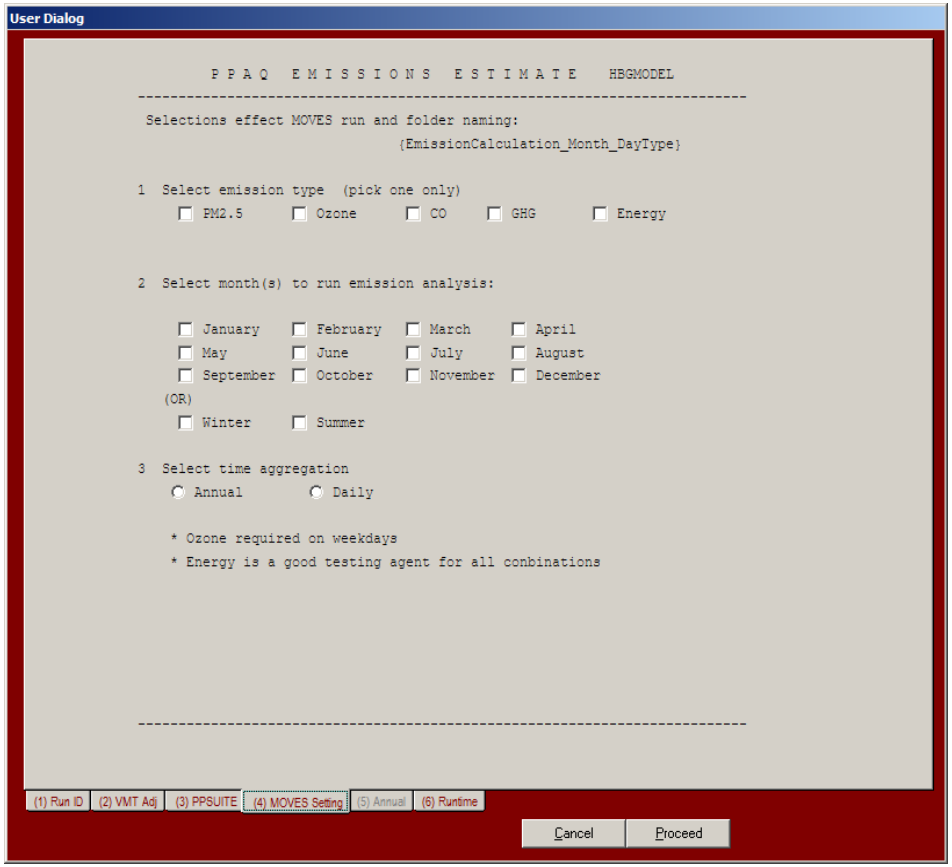
- Run using input ASCII driver files
- Defined keywords
- Many different functions with flexible framework
- Most develop key input files

```
!====================== Define Facility Groups ========================
DEFINE FACTGROUP = FACTYPE        ! [FCLASS | FACTYPE {Default}]
  1   = 1                         ! Freeway Rural
  2   = 2                         ! Major Arterial Rural
  6   = 6                         ! Minor Arterial Rural
  7   = 7                         ! Major Collector Rural
  8   = 8                         ! Minor Collector Rural
  9   = 9                         ! Centroid Connector/Local Rural
 11   = 11                        ! Freeway Urban
 14   = 14                        ! Major Arterial Urban
 16   = 16                        ! Minor Arterial Urban
 17   = 17                        ! Centroid Connector/Local Urban
 19   = 19                        ! Local Arterial
 20   = 20                        ! Ramp/Metered Ramp Rural
 21   = 21                        ! Ramp/Metered Ramp Urban
END

!======================== Define Time Groups ==========================
DEFINE TIMEGROUP
   TIMEAM    7 8 9
   TIMEMID   10 11 12 13 14 15
   TIMEPM    16 17 18
   TIMENITE  19 20 21 22 23 24 1 2 3 4 5 6
END

!======== User Definition Of Vehicle Types For Traffic Analysis ========
DEFINE VEHTYPES          ! Minimum of 2 - Max of 28
  1 = AUTO    AUTO       ! Passenger Car, MC, and Light Trucks
  2 = SUT     TRUCK      ! Single Unit Trucks and Buses
  3 = MUT     TRUCK      ! Combination Trucks
END
```

# Role of CENTRAL

- Provides user interface screens
- Combine multiple steps into one process
- File management and naming
- Error tracking
- Combine model runs / air quality



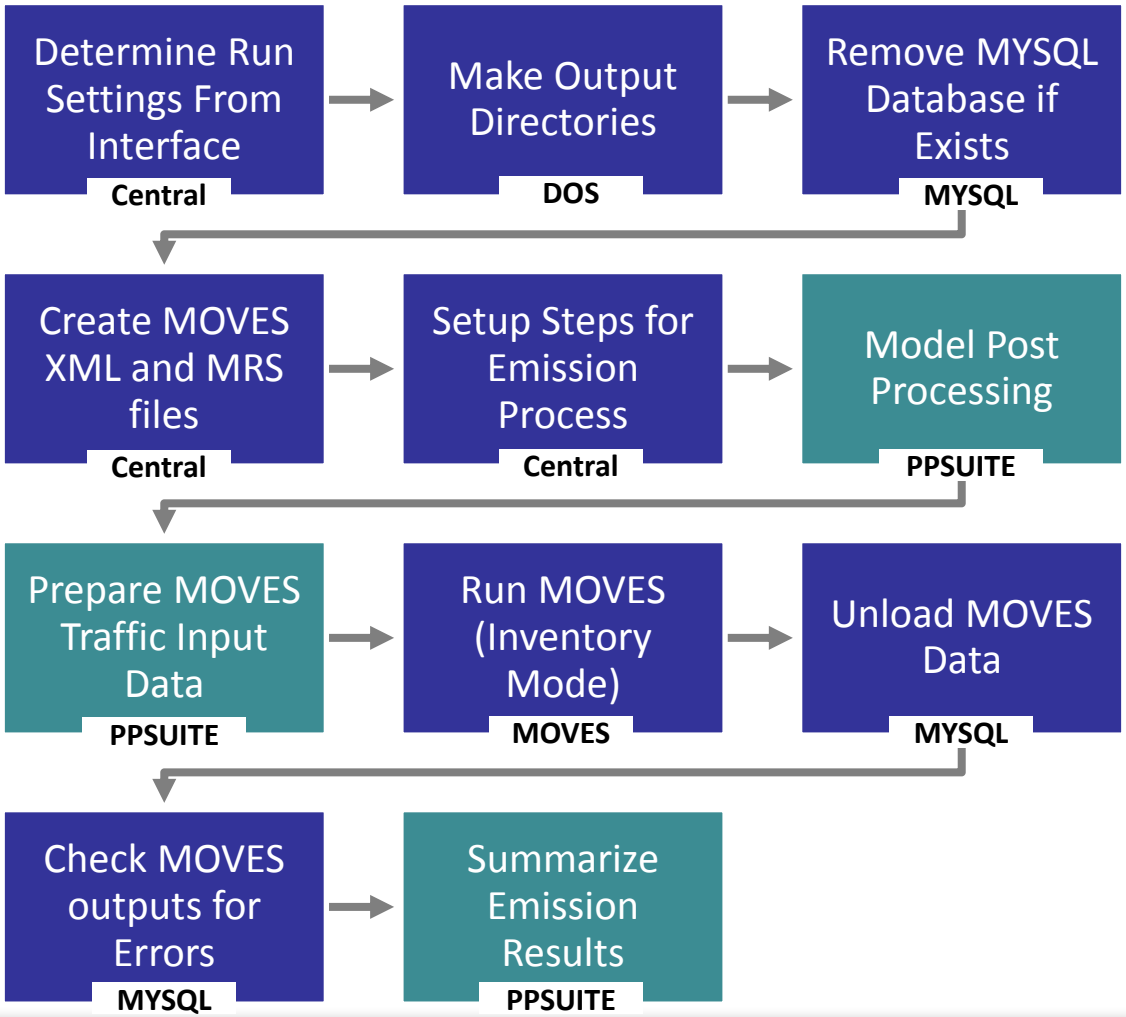



# How to Setup Central

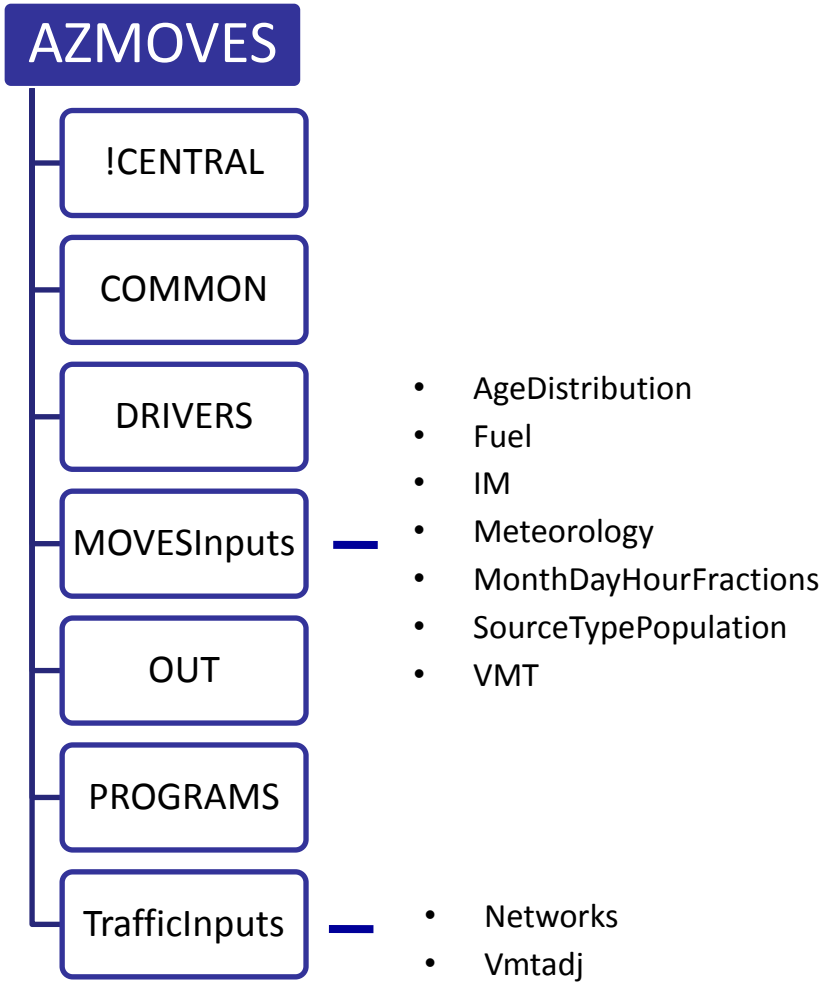
- Run using input ASCII driver files
- Like a programming language
- Specify macro variables
- Defined keywords

```
SCREEN 6 if %MOVES=on
      name = TrafficInputs
       %NetworkAB     type=file
       %NetworkBA     type=file
       %vehmix        type=file
       %hourpatt      type=file
       %hpmsadj       type=file

|                          ARIZONA MOVES-PPSUITE PROCESS                          |
|                Specify Traffic Data Inputs for Emission Process                 |
| ------------------------------------------------------------------------------  |
|                                                                                 |
|  Network Database - AB Links:                                                   |
|      [                                                                ]  |%NetworkAB
|                                                                                 |
|  Network Database - BA Links:                                                   |
|      [                                                                ]  |%NetworkBA
|                                                                                 |
|  Vehicle Mix File:                                                              |
|      [                                                                ]  |%vehmix
|                                                                                 |
|  Hourly Pattern File:                                                           |
|      [                                                                ]  |%hourpatt
|                                                                                 |
|  HPMS Adj File:                                                                 |
|      [                                                                ]  |%hpmsadj
|     VMT Reconciliation To HPMS Reported Totals. Applied as POSTVMT Factors.     |
|                          --  Leave Blank if Not Used  --                        |
>BLOCK RUNCTY
*------------------------ Santa Cruz COUNTY -------------------------------------
>LINEIF %runSANT = ON THEN >GLOBAL  %cty = "Santa Cruz County" %cty4 = SANT
>LINEIF %runSANT = ON THEN >GLOBAL SET %cty4fips = 4023
* Make and Set Directories Under Out Directories
>LINEIF %runSANT = ON THEN >GLOBAL SET %dirout =
%$$workdir.Out\%RunDesc.\%OutDirNameIni.%cty4fips._%calyear._%monthID._%dayID._%Mpolicy.\
>LINEIF %runSANT = ON THEN >DOS mkdir %dirout.MVS
>LINEIF %runSANT = ON THEN >DOS mkdir %dirout.CDM
```

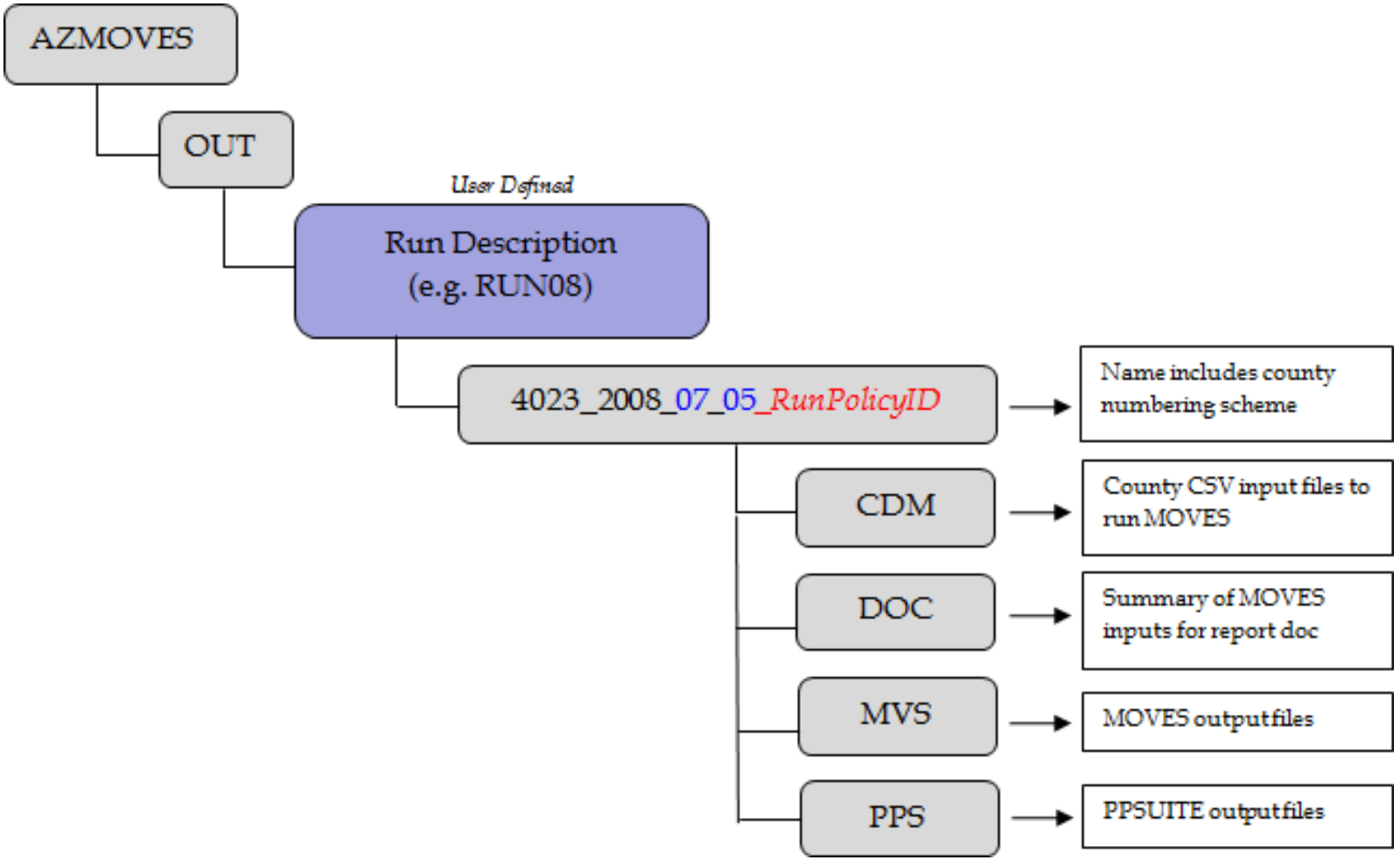
# Case Study Batch Process Flowchart



# Process Directory Structure



# Output Directory Naming



# Preparing Process Inputs

→ Roadway Data Inputs

- Statewide travel model data input to PPSUITE for processing
- Key tasks:
  - ✓ Reformatting (could be accomplished in ACCESS, EXCEL or other database software.
  - ✓ Additional of ROADTYPE variable for MOVES
  - ✓ Separation into 2 input databases (AB / BA direction)

# Arizona Statewide Model Data Used

| Field Type | Use |
|---|---|
| Length | To compute VMT for each segment |
| Facility Type | Lookup of other link attributes (e.g. capacities, signal characteristics, congested speed curve coefficients) |
| Area Type | |
| Speed Limit | Free-flow speed |
| Lanes | To determine total capacity of link |
| Daily Volume | Daily volume to distributed to each hour of the day |
| AM Peak Period Volume | Adjust hourly pattern to ensure match with model peak volumes |
| PM Peak Period Volume | |
| Daily Truck Volume | Adjust vehicle mix pattern to match truck volume on each link |
| Roadtype | Used to aggregate data for input to MOVES |

# Preparing Process Inputs

## → 2008 HPMS Adjustments

- Reconcile model results to reported 2008 HPMS totals

| FC | FC Description | 2008 HPMS AADT | 2008 Model Raw VMT |
|---|---|---|---|
| 1 | Rural Freeway | 283,487 | 376,715 |
| 2 | Rural Major Arterial | 0 | 642 |
| 6 | Rural Minor arterial | 0 | 0 |
| 7 | Rural Major Collector | 59,845 | 225,195 |
| 8 | Rural Minor Collector | 38,367 | 291 |
| 9 | Rural Centroid Connector/Local | 625,767 | 91,926 |
| 11 | Urban Freeway | 312,888 | 171,909 |
| 14 | Urban Major Arterial | 175,201 | 47,042 |
| 16 | Urban Minor arterial | 154,021 | 42,224 |
| 17 | Urban Collector | 43,630 | 120,772 |
| 19 | Urban Centroid Connector/Local | 122,205 | 29,234 |
| 20 | Rural Ramp/Metered Ramp | | 3,347 |
| 21 | Urban Ramp/Metered Ramp | | 2,053 |
| | | **1,815,411** | **1,111,350** |

| FC Grouping | 2008 HPMS AADT | 2008 Model Raw VMT | 2008 HPMS Adjustments |
|---|---|---|---|
| 1, 11, 12 (20, 21) | 596,375 | 554,024 | 1.0764 |
| 2, 6, 14, 16 | 329,222 | 89,908 | 3.6618 |
| 7, 8, 9, 17, 19 | 889,814 | 467,418 | 1.9037 |
| **Sum Total** | **1,815,411** | **1,111,350** | |

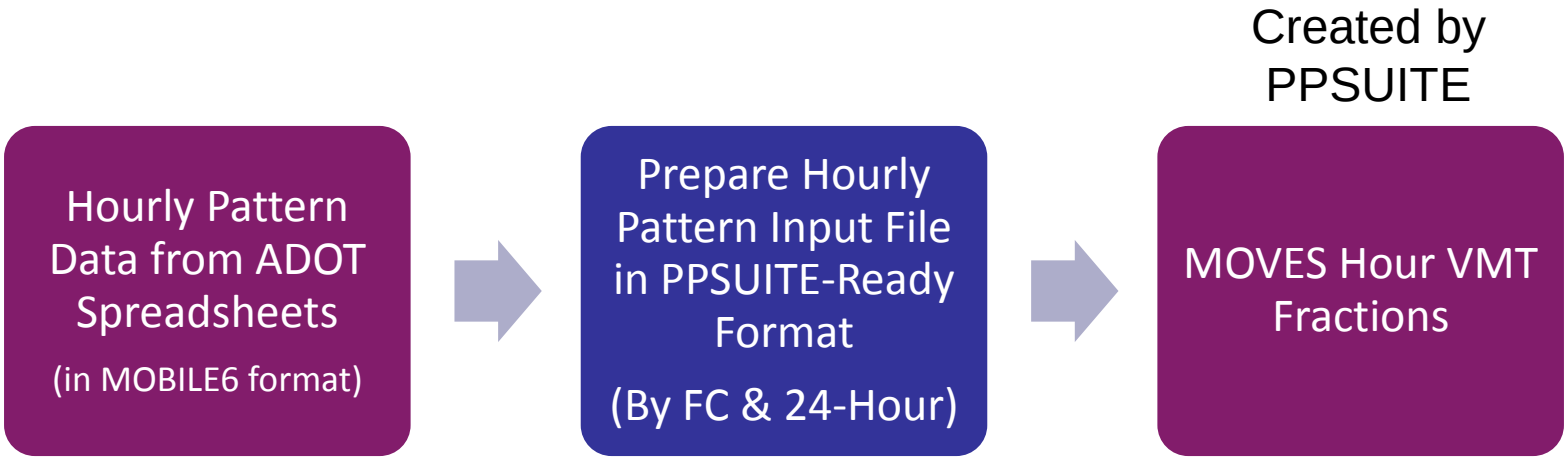
# Preparing Process Inputs

## → Vehicle Type Mix

| VMT Data Source | | MOVES Source Type Mapping | Calculate Vehile Mix Distribution |
|---|---|---|---|
| AZ Statewide Model | Auto | **Auto by MOVES Source Type**<br>11_Motorcycle<br>21_ Passenger Car<br>31_Passenger Truck<br>32_Light Commercial Truck ← | **Auto VMT Mix**<br>Based on MOVES Default VMT Mix (AZ Statewide 2008 Total) Normalized by Auto Grouping<br>[Does not vary by county & road type] |
| | SUT | **SUT by MOVES Source Type**<br>42_Transit Bus<br>43_School Bus<br>41_Intercity Bus<br>51_Refuse Truck<br>52_Single Unit Short-haul Truck<br>53_Single Unit Long-haul Truck<br>54_Motor Home | **SUT VMT Mix**<br>Based on MOVES Default VMT Mix (AZ Statewide 2008 Total) Normalized by SUT Grouping<br>[Do not vary by county & road type] |
| | MUT | **MUT by MOVES Source Type**<br>61_Combination Short-haul Truck<br>62_Combination Long-haul Truck | **MUT VMT Mix**<br>Based on MOVES Default VMT Mix (AZ Statewide 2008 Total) Normalized by MUT Grouping<br>[Does not vary by county & road type] |

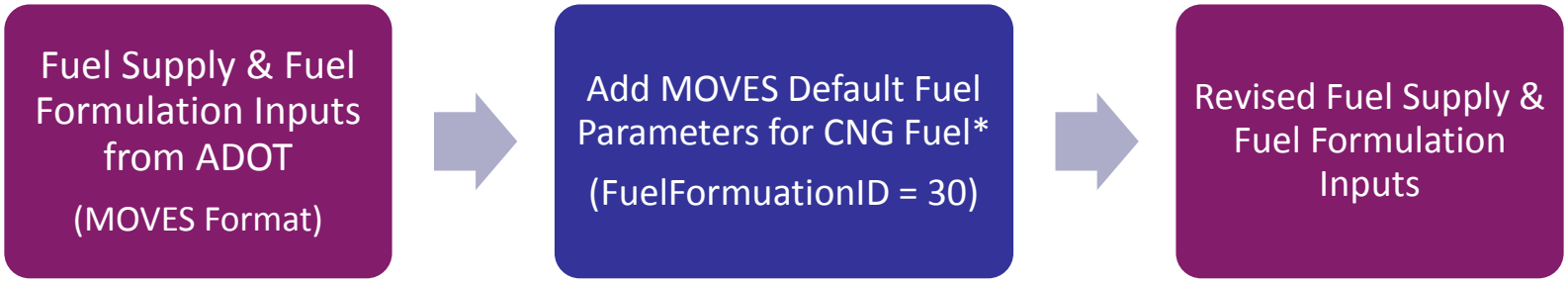
# Preparing Process Inputs

## → Hourly Pattern Data / Hour VMT Fractions



# Preparing Process Inputs

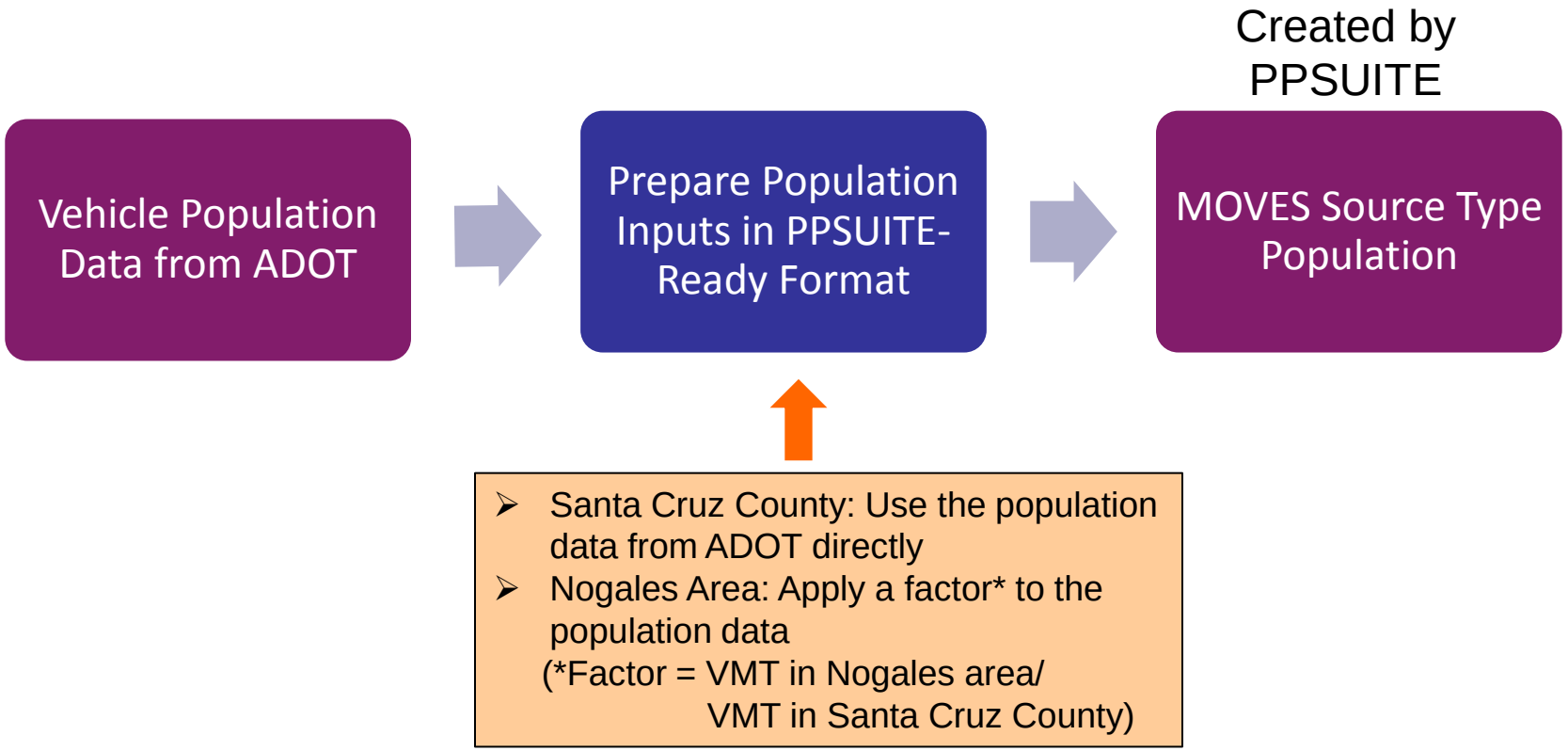
## → Fuel Parameters




** Note: CNG fuel is included in MOVES RunSpec in addition to gasoline and diesel fuels per EPA Technical Guidance for SIP and Conformity*

# Preparing Process Inputs

## → Vehicle Population Data



# Preparing Process Inputs

## → Other Inputs Used Directly From ADOT Sample Files for Santa Cruz County

Day VMT Fractions

Month VMT Fractions

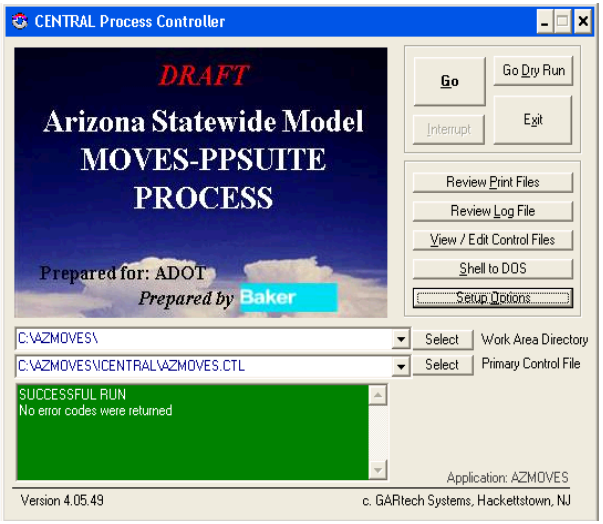
Temps/Humidity

# Process Demonstration

Examine process setups

Illustrative test run

Review file management and directory structure



# Sample Summary of Speed Results

Sample

| Road Type | Santa Cruz (MPH) | Nogales (MPH) |
|---|---|---|
| Rural Restricted | 73.7 | N/A |
| Rural Unrestricted | 32.3 | 51.7 |
| Urban Restricted | 67.7 | N/A |
| Urban Unrestricted | 35.1 | 34.0 |
| **County/Area Average** | **40.8** | **36.0** |

# Sample Run Results (2008 July Weekday)

Sample

| Run Description | Area of Analysis | VMT | PM2.5 Total (Tons/Day) | PM10 Total (Tons/Day) | PM10 Elemental Carbon (Tons/Day) |
|---|---|---|---|---|---|
| PPSUITE Process Run 1<br>Apply County HPMS Factors | Nogales | 698,472 | 0.039 | 0.055 | 0.017 |
| PPSUITE Process Run 2<br>Match County HPMS VMT | Santa Cruz | 2,106,750 | 0..183 | 0.226 | 0.112 |

# Process Demonstration

- AP-42 Spreadsheet Calculation Tool
- ADEQ 2012 SIP Methodologies
- Local VMT from MOVES runs

**Sample Paved Road Baseline Emissions**

Default Values Obtained from the ADEQ, *Final 2012 State Implementation Plan Moderate $PM_{10}$ Nonattainment Area*

| Particle Size Multiplier (k) | Road Surface Silt Loading (sL) ($g/m^2$) | Average Weight of Vehicles (W) | Number of Wet Days (P) | Number of Days in Averaging | $PM_{10}$ / $PM_{2.5}$ Ratio |
|---|---|---|---|---|---|
| 0.0022 | 0.105 | 3 | 45 | 365 | 0.25 |

Sample

# Process Demonstration

- Background on TCMs
- Sample Quantification of TCM in the SIP
  - *Pave or Chemically Stabilize Unpaved Roads*
- Spreadsheet Calculation Tool
  - 6 Lane Miles Paved
  - ADT = 100

# Sample Nogales $PM_{10}$ Results (Annual)

Sample

| | Unpaved Road Dust | Road Construction Dust | Paved Road Dust | On-Road[1] |
|---|---|---|---|---|
| MVEBs | 864.9 | 267.0 | 121.4 | 21.0 |
| Sample Analysis | 619.65 | 267.0[2] | 92.62 | 17.35 |
| Difference | 245.25 | 0.0 | 28.78 | 3.65 |
| Pass / Fail | Pass | Pass | Pass | Pass |

1. Includes on-road gasoline, and diesel vehicle emissions, including brake, tire wear, and vehicle exhaust
2. SIP assumes no change: *"There have been no substantial road construction projects in the Nogales NA in the last five years and no projects are planned for the next five years."*
3. Based on July weekday, multiplied by 315.38

# Possible Process Modifications

- Alternatives for Determining Nogales VMT
  - ✓ Methods to account for missing local VMT
  - ✓ Available Local Planning Assumptions
- Methods for Vehicle Mapping
  - ✓ What MOVES types relate to model truck categories
- Methods for estimating Nogales Vehicle Population
- Adj/Calibration of Input Capacity Lookup Tables
- Integration of seasonal factors / hourly patterns
- Customization of User Menu System
- Customized tool(s) for off-network analyses (AP-42, AQONE)